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ABSTRACT

Two validity studies of the College Board College-Level Examination Program (CLEP) Subject Examination in Elementary Computer Programming: Fortran IV determined that CLEP scores are appropriate for granting examination credit at the University of Texas at Austin. The standard-setting administration was in the spring of 1979, with a re-evaluation in the spring of 1982. This CLEP test measures knowledge, understanding and skills equivalent to those normally gained in one semester of an introductory college course in Fortran IV. Students enrolled in Electrical Engineering 212 took the CLEP test as a final examination and instructors submitted preliminary course grades prior to testing to establish a grade relationship with CLEP scaled scores. The relationship of examination and course performance was examined in terms of descriptive statistics, expected grades, possible decision scores, placement accuracy, and scoring guidelines. In 1979 a score of 48 was recommended for credit with the minimally satisfactory grade of C, and 55 and 62 were suggested for credit with the grades B and A, respectively. In 1982 the decision score for credit with a grade of C was recommended to be 51, a grade of B at 57 and a grade of A at 60. (CM)

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TWO VALIDITY STUDIES OF CLEP SUBJECT EXAMINATION IN ELEMENTARY COMPUTER PROGRAMMING: FORTRAN IV, U.T. AUSTIN, SPRING 1979 AND SPRING 1982

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TWO VALIDITY STUDIES OF CLEP SUBJECT EXAMINATION IN ELEMENTARY COMPUTER PROGRAMMING: FORTRAN IV, U.T. AUSTIN, SPRING 1979 AND SPRING 1982

Anne B. Appenzellar and H. Paul Kelley

Acting at the request of the Department of Electrical Engineering at The University of Texas at Austin, the Measurement and Evaluation Center (MEC) conducted two validity studies of the College Board College-Level Examination Program (CLEP) Subject Examination in Elementary Computer Programming: Fortran IV--a standard-setting administration in the Spring of 1979 and a re-evaluation in the Spring of 1982.

This bulletin reports the methodologies and results of both studies. Because of their similarities, the methodologies of the two studies are treated in common, while the results are treated separately.

Prior to January, 1980, credit by examination in Electrical Engineering Computation I was awarded on the basis of student performance on the locally-constructed U.T. Austin Placement Test in Electrical Engineering 212. During the spring months of 1979, Electrical Engineering 212 instructors examined an inspection copy of the CLEP Subject Examination in Elementary Computer Programming: Fortran IV and asked the MEC to assist them in determining CLEP scores appropriate for granting credit at U.T. Austin on the basis of student performance on this standardized test.

Method

Materials

The CLEP Subject Examination in Elementary Computer Programming: Fortran IV is designed to measure knowledge, understanding, and skills equivalent to those normally gained from one semester of an introductory college course in Fortran IV. The objective section of the test is composed of approximately 100 multiple-choice questions that are to be completed in 90 minutes.

The test is not concerned with any particular computer or related types of hardware, nor does it attempt to measure the student's mastery of the general field of data processing. Because of the many variations of Fortran IV in use today, this examination attempts to measure only those elements of the language that are common to most users.

Additional information about the contents of the test and a set of sample questions are to be found in Appendix A. The same form of the test was used in both studies.

Subjects

Participants in the validity studies of Spring 1979 and Spring 1982 were students enrolled in Electrical Engineering 212, a one-semester course in Fortran computer programming. The course is designed to teach engineering students how to use Fortran IV to solve engineering problems. Mathematics 808A (Calculus I) is a prerequisite (or parallel) course for Electrical Engineering 212. Two semester hours of credit may be earned for successful completion of the course.

In Spring 1979, the curriculum was presented in two 50-minute lecture periods and two 50-minute laboratory periods per week. Two of three registered sections were involved in the study; their combined enrollment on the 12th class day totaled 236.

In Spring 1982, the curriculum was presented in one 50-minute lecture period and two 50-minute laboratory periods per week. All 11 registered sections were involved in the study; their combined enrollment was 326 on the 12th day of classes. Additional details about the course may be obtained from the Spring 1982 outline and information sheet replicated in Appendix A.

Procedures

For both studies, data collection by the MEC included the administration of the CLEP test as the final examination in Electrical Engineering 212 and the conversion of raw scores to CLEP scores scaled on a range of 20-80 with a mean (average) score of 50 and a standard deviation (a measure of the varia-

bility among the scaled scores) of 10. The student's performance on the test counted as 20% of his/her final grade in the course.

In addition, MEC staff members asked the instructor of Electrical Engineering 212 to submit his evaluation of each student's course performance at the end of the semester but prior to administration of the CLEP test as the final examination in the course. In this report, these evaluations are called preliminary course grades; they were computed before the instructor was advised of the results of the test. They are reported on two scales: (a) the usual four-point scale (F to A or 0 to 4) for stating grade-point averages and (b) an expanded scale that adds plus and minus signs (F- to A+ or 0 to 14). The latter distributes the grades over a wider range and usually results in more precise estimates of the desired decision scores.[1]

For completing the students' final grades in Electrical Engineering 212 each of the two spring semesters, MEC staff members assisted the instructor and his associates (teaching assistants and assistant instructors) in establishing a rough relationship between the test scores and the preliminary course grades. In post-examination conferences planned for the exchange of test results for preliminary course grade rosters, MEC staff members delivered alphabetical rosters, by section, with CLEP scores to the right of each student's name, and frequency distributions of those scores, by section and for the course as a whole. In addition, the distributions of the scores also reported the mean scores and standard deviations, by section and by course.

The design prepared in advance for further MEC analysis of the data focused upon a determination of the relationship between the students' performance on the CLEP examination and their performance in the course. Correlations were obtained for the course as a whole, as well as equations that enabled MEC to estimate expected grades and expected test scores for various groups of students.

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[1]Results using the 14-point scale are reported in Tables 1-4 of the Results and Discussion section of this bulletin; results using the four-point scale are reported in similar tables in Appendix B.

Upon completion of the data analyses, MEC staff members made several recommendations to the instructional staff about decision scores; they used certain guidelines that have been suggested by various authorities for use in determining minimum scores to qualify students for credit by examination. After discussion and joint consideration of the effects of various levels of decision scores, the departmental representative made the final decision of the minimum score to be used for granting credit with a letter grade of C and of the score intervals to use for granting credit with two additional letter grades (A and B).

Results and Discussion

Spring Semester 1979

The CLEP test was administered as the final examination in Electrical Engineering 212 to 60 students on May 14 and to 51 students on May 15, 1979.

The mean score of the 111 students who took the test was 55 with a standard deviation of 8. On the four-point (0-4) scale, their mean preliminary course grade was 2.99 (a high C or almost a low B) with a standard deviation of 1.13; on the 0-14 scale, the mean preliminary course grade was 9.95 (B- or almost a B) with a standard deviation of 3.55. The correlation coefficient between the CLEP scores and preliminary course grades was .59 on each scale.

CLEP scores ranged from a low of 36 (one student with a preliminary course grade of F) to a high of 70 (two students with preliminary grades of A). The distribution of preliminary course grades was weighted toward satisfactory performance in the course; 87% of the students were assigned preliminary course grades of A, B, or C, while the remaining 13% made the passing but unsatisfactory grade of D or the failing grade of F.

Table 1 reports these results in a format that presents the distribution of CLEP scores (lefthand column) by the distribution of preliminary course grades in 15 grade groups (F- to A+) in the middle columns and for the class as a whole in the righthand column. Also reported in the lower

Table 1

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Frequency Distributions, Descriptive Statistics, and Expected Grades
Spring Semester 1979

	Preliminary Course Grades (0-14) in EE 212														
Test Scores	0 F-	1 F	2 F+	3 D-	4 D	5 D+	6 C-	7 C	8 C+	9 B-	10 B	11 B+	12 A-	13 A	14 A+	Total
70-80														1	1	2
66-69														3	2	5
65													1	2	2	5
64														2		2
63												2		2	1	5
62										2			1	2	3	8
61										1			1	2	1	5
60				1						2		1	1		2	7
59										1				1		2
58								1		4		1	1		2	9
57									1	2				1		4
56					1			1					2	1	1	6
55										1						1
54				1	1			1		2		2		1		8
53		1													1	2
52									1	2		1	1			5
51					1				1	2	1		1		1	7
50								1						1		2
49					2					1				1	1	5
48									1	1						2
47		2			1					1						5
46								1	1							2
45												1				1
44																0
43					1			1								2
42							1			1		1				3
41																0
40		1							1	1						3
39																
38					1											1
37										1						1
36		1														1
35																
34																
33																
32																
31																
20-30																
Total	0	5	0	2	7	0	1	7	7	25	1	9	9	20	18	111
	0%	5%	0%	2%	6%	0%	1%	6%	6%	23%	1%	8%	8%	18%	16%	100%
Mean Score	--	45	--	57	50	--	42	49	49	54	51	55	58	61	61	55
Standard Deviation	--	7	--	4	4	--	0	7	5	7	0	7	5	6	6	8
Expected Score	43	44	45	46	48	49	50	52	53	54	55	57	58	59	61	

Expected Score = $\left(\text{Prelim. Grade} \times 1.2788\right) + (42.5875)$

Mean Grade	Standard Deviation
9.95	3.55

Correlation Coefficient
r = .59

third of Table 1 are the numbers and percentages of students in each grade group, the mean CLEP score and the standard deviation for each of these 15 groups and for the class as a whole, and (at the lower right) the mean preliminary course grade and its standard deviation for the total group as well as the correlation coefficient between the 111 CLEP scores and preliminary course grades on the 0-14 scale.

Using these statistics, an equation was calculated to predict the scores that will be made on this test by future students seeking to earn credit by examination for Electrical Engineering 212. This prediction (or more technically, regression) equation is shown at the right of Table 1. With this prediction equation, expected scores were found for each of the 15 grade groups; these 15 expected scores are shown in the bottom row of the table.

Table 2 repeats the frequency distribution of CLEP scores from Table 1 but collapses the 15 grade groups into two, one of which represents satisfactory performance (A+ - C-) in the course, the other, unsatisfactory performance (D+ - F-). In its second column, this table adds the course grade to be expected for students scoring at each score interval. The regression equation that predicts the level of future course performance on the basis of the student's CLEP score is shown at the right of Table 2. Mean CLEP scores and their standard deviations are also given for the two grade groups (A+ - C- and D+ - F-).

Table 3 shows what the accuracy and inaccuracy of placement decision would have been if their scores on the CLEP test had been used to place these 111 students in or out of Electrical Engineering 212. This analysis is based on the frequency distributions presented in Table 2; it (the analysis) compares the test's evaluation of the students' knowledge of the subject with the instructor's evaluation of their performance in the course, as revealed by the preliminary course grades.

Table 2

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Combined Frequency Distributions and Expected Grades Spring Semester 1979

Test Scores	Expected Grades	Course Grades (0-14) Unsatisf. D-F	Satisf. A-C	Total
70-80	13.88-14.0		2	2
66-69	12.81-13.61		5	5
65	12.54		5	5
64	12.27		2	2
63	12.01		5	5
62	11.74		8	8
61	11.47		5	5
60	11.20	1	6	7
59	10.94		2	2
58	10.67		9	9
57	10.40		4	4
56	10.13	1	5	6
55	9.86		1	1
54	9.60	2	6	8
53	9.33	1	1	2
52	9.06		5	5
51	8.79	1	6	7
50	8.52		2	2
49	8.26	2	3	5
48	7.99		2	2
47	7.72	3	2	5
46	7.45		2	2
45	7.19		1	1
44	6.92			
43	6.65	1	1	2
42	6.38		3	3
41	6.11			
40	5.85	1	2	3
39	5.58			
38	5.31		1	1
37	5.04		1	1
36	4.78	1		1
35	4.51			
34	4.24			
33	3.97			
32	3.70			
31	3.44			
20-30	0.49-3.17			
Total	--	14	97	111
%	--	13 %	87 %	100%
Mean Score	--	49	56	55
Standard Deviation	--	6	8	8

Expected Grade =

$$\left(\text{Test Score} \times .2678\right) - (4.8651)$$

Mean Grade	Standard Deviation
9.95	3.55

Correlation Coefficient

r = .59

Table 3

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Possible Decision Scores and Corresponding Accuracies of Placement
Spring Semester 1979
(N = 111)

	Cumulative Numbers of Students				Percent of Students in Each Placement Category				Overall Accuracy of Placement		
Placement Category	Unsatisfactory D-F (N=14)		Satisfactory A-C (N=97)		Unsatisfactory D-F		Satisfactory A-C		Accuracy Category	No. of Students	% of Students
60 - up	Too High	1	38	OK	Too High	7 %	39 %	OK	Too High	1	1 %
Below 60	OK	13	59	Too Low	OK	93 %	61 %	Too Low	Correct	51	46 %
									Too Low	59	53 %
59 - up	Too High	1	40	OK	Too High	7 %	41 %	OK	Too High	1	1 %
Below 59	OK	13	57	Too Low	OK	93 %	59 %	Too Low	Correct	53	48 %
									Too Low	57	51 %
58 - up	Too High	1	49	OK	Too High	7 %	51 %	OK	Too High	1	1 %
Below 58	OK	13	48	Too Low	OK	93 %	49 %	Too Low	Correct	62	56 %
									Too Low	48	43 %
57 - up	Too High	1	53	OK	Too High	7 %	55 %	OK	Too High	1	1 %
Below 57	OK	13	44	Too Low	OK	93 %	45 %	Too Low	Correct	66	59 %
									Too Low	44	40 %
56 - up	Too High	2	58	OK	Too High	14 %	60 %	OK	Too High	2	2 %
Below 56	OK	12	39	Too Low	OK	86 %	40 %	Too Low	Correct	70	63 %
									Too Low	39	35 %
55 - up	Too High	2	59	OK	Too High	14 %	61 %	OK	Too High	2	2 %
Below 55	OK	12	38	Too Low	OK	86 %	39 %	Too Low	Correct	71	64 %
									Too Low	38	34 %
54 - up	Too High	4	65	OK	Too High	28 %	67 %	OK	Too High	4	4 %
Below 54	OK	10	32	Too Low	OK	72 %	33 %	Too Low	Correct	75	67 %
									Too Low	32	29 %
53 - up	Too High	5	66	OK	Too High	36 %	68 %	OK	Too High	5	5 %
Below 53	OK	9	31	Too Low	OK	64 %	32 %	Too Low	Correct	75	68 %
									Too Low	31	28 %
52 -up	Too High	5	71	OK	Too High	36 %	73 %	OK	Too High	5	5 %
Below 52	OK	9	26	Too Low	OK	64 %	27 %	Too Low	Correct	80	72 %
									Too Low	26	23 %
51 - up	Too High	6	77	OK	Too High	43 %	79 %	OK	Too High	6	5 %
Below 51	OK	8	20	Too Low	OK	57 %	21 %	Too Low	Correct	85	77 %
									Too Low	20	18 %

Continued

Table 3 (Continued)

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Possible Decision Scores and Corresponding Accuracies of Placement
Spring Semester 1979 (Continued)
(N = 111)

	Cumulative Numbers of Students				Percent of Students in Each Placement Category				Overall Accuracy of Placement		
Placement Category	Unsatisfactory D-F (N=14)		Satisfactory A-C (N=97)		Unsatisfactory D-F		Satisfactory A-C		Accuracy Category	No. of Students	% of Students
50 - up	Too High	6	79	OK	Too High	43 %	81 %	OK	Too High	6	5 %
									Correct	87	78 %
Below 50	OK	8	18	Too Low	OK	57 %	19 %	Too Low	Too Low	18	16 %
49 - up	Too High	8	82	OK	Too High	57 %	85 %	OK	Too High	8	7 %
									Correct	88	79 %
Below 49	OK	6	15	Too Low	OK	43 %	15 %	Too Low	Too Low	15	14 %
48 - up	Too High	8	84	OK	Too High	57 %	87 %	OK	Too High	8	7 %
									Correct	90	81 %
Below 48	OK	6	13	Too Low	OK	43 %	13 %	Too Low	Too Low	13	12 %
47 - up	Too High	11	86	OK	Too High	79 %	89 %	OK	Too High	11	10 %
									Correct	89	80 %
Below 47	OK	3	11	Too Low	OK	21 %	11 %	Too Low	Too Low	11	10 %
46 - up	Too High	11	88	OK	Too High	79 %	91 %	OK	Too High	11	10 %
									Correct	89	82 %
Below 46	OK	3	9	Too Low	OK	21 %	9 %	Too Low	Too Low	11	10 %
45 - up	Too High	11	89	OK	Too High	79 %	92 %	OK	Too High	11	10 %
									Correct	92	83 %
Below 45	OK	3	8	Too Low	OK	21 %	8 %	Too Low	Too Low	8	8 %
↓											
41 - up	Too High	12	93	OK	Too High	86 %	96 %	OK	Too High	12	11 %
									Correct	95	86 %
Below 41	OK	2	4	Too Low	OK	14 %	4 %	Too Low	Too Low	4	4 %
↓											
37 - up	Too High	13	97	OK	Too High	93 %	100 %	OK	Too High	13	12 %
									Correct	98	88 %
Below 37	OK	1	0	Too Low	OK	7 %	0 %	Too Low	Too Low	0	0 %

At the left of Table 3 are the CLEP scores of interest to the investigators and the department. The next column records the number of students with unsatisfactory course performance (i.e., preliminary grades of D+ to F-) who would have been placed too high or correctly on the basis of a given test score; that is, their scores would have placed them out of the course but their grade indicates that they needed to take the course. The third column records the number of students with satisfactory performance (i.e., preliminary grades of A+ to C-) who would have been placed correctly and those who would have been placed too low--that is, their scores would have required them to take the course but their grade indicates that they know the material sufficiently well to be placed out of the course with credit by examination for Electrical Engineering 212.

For example, a score of 50 would have placed six of the 14 students with grades of D+ to F- too high, in view of their unsatisfactory performance in the course, and eight of them correctly; the score of 50 would have placed 79 of the 97 students with grades of A+ to C- correctly and 18 of them too low, in view of their satisfactory performance in Electrical Engineering 212.

The fourth and fifth columns of Table 3 convert these numbers to percentages, while the two righthand columns report the accuracy/inaccuracy of placement for all grade groups combined. The number of errors of placement too high and too low are repeated, while the correct placement decisions of the two grade groups are totaled; both numbers and percentages are given.

Table 4 lists some possible decision scores that might be used for placement and credit by examination; they are chosen on the basis of six suggested guidelines that have proved useful on several college campuses. The expected score for students with a preliminary grade of C- is 50 (see Table 1, bottom row of the C-grade groups), while the score for which the expected grade was the minimally satisfactory one of C- is 41 (see second column of Table 2, the grade of 6.11). The within-category percentages of error (too high and too low) are most nearly equal at the CLEP score of 53 (see Table 3, middle columns), while the overall percentages of error are most nearly equal at 47 (see last column at right of Table 3). The score that would cut off (or place into Electrical Engineering 212) the same number of students as are in the unsatisfactory performance group (N=14) is

Table 4

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Scores Suggested by Six Guidelines for Selecting Decision Scores on CLEP Subject Examination in Elementary Computer Programming-Fortran IV (0-14 scale) Spring Semester 1979 (N=111)

Guideline	Score
1. Expected score for students whose performance in course was just minimally satisfactory--i.e., students with preliminary grades of C-. (See Expected Score row at bottom of Table 1.)	50
2. Score for which expected grade was just minimally satisfactory--i.e., C-. (See Expected Grade column in Table 2.)	41
3. Score for which percents of errors of students in each academic performance category (Unsatisfactory, Satisfactory) were most nearly equal. (See % Too High and % Too Low values in middle columns of Table 3.)	53
4. Score for which overall percents of errors were most nearly equal. (See % Too High and % Too Low values in last column of Table 3.)	47
5. Score that would have cut off (or held back) approximately the same number of students as were in the Unsatisfactory performance group. (See Table 2 for numbers of students in Unsatisfactory group and the test score that most nearly identifies that number of low-scoring students, as totaled in last column.)	47
6. Score that would have maximized overall accuracy of placement. (See number and percentages Correct in next-to-last column of Table 3.)	37

also 47 (see righthand column of Table 2), and the score maximizing the overall accuracy of placement is 37 (see righthand column of Table 3).

Selection of the decision scores for credit by examination in Electrical Engineering 212 took place on December 21, 1979, during a telephone conference between the MEC director and the instructor of Electrical Engineering 212. The MEC recommendation was a score of 48 for credit with the minimally satisfactory grade of C, with 55 and 62 suggested for credit with the letter grades of B and A, respectively. The instructor's somewhat more conservative choices were as follows:

CLEP Score Interval	Credit/No Credit
64-80	Credit with letter grade of A
57-63	Credit with letter grade of B
50-56	Credit with letter grade of C
20-49	No credit

The CLEP Subject Examination in Elementary Computer Programming: Fortran IV was administered during Spring 1980 and the testing years (June-May) 1980-1981 and 1981-1982 to 45 candidates for credit by examination in Electrical Engineering 212. To date, 39 students have earned credit eligibility, 22 with the grade of A, 10 with the grade of B, and seven with the grade of C; these results represent 78 semester hours of credit in Electrical Engineering 212. The success rate was 87%.

Spring Semester 1982

Because of modifications instituted in curriculum and methodology over a three-year period, the instructor of Electrical Engineering 212 asked the MEC to re-evaluate the 1979 decision scores on the basis of data collected during the 1982 Spring Semester. The CLEP test was administered to 297 students as the final examination on May 18, 1982.

The mean CLEP score of the 274 students with both test scores and preliminary course grades was 58 with a standard deviation of 9. On the four-point (A-F) scale, the mean preliminary course grade was 3.05 (B) with a standard deviation of 1.24; on the 14-point (0-14) scale, the mean preliminary course grade was 10.16 (B) with a standard deviation of 3.82.[1] The correlation between the two measures of student performance was .62 on the 0-4 scale and .65 on the 0-14 scale.

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[1]Results using the 14-point scale are reported in Tables 5-8 of the Results and Discussion section of this bulletin; results using the four-point scale are reported in similar tables in Appendix B.

Scores ranged from a low of 33 (two students with preliminary grades of F) to a high of 75 (one student with a preliminary grade of A).

The distribution of preliminary course grades was again weighted toward satisfactory performance in the course; 86% of the 274 students were assigned preliminary grades of A, B, or C, while 14% made the passing but unsatisfactory grade of D or the failing grade of F.

As in the report of the results of the 1979 validity study, Tables 5 and 6 present the distribution of CLEP scores by the 15 grade groups (F- to A+ on the 0-14 scale, Table 5) and by the two grade groups combined (Table 6) as satisfactory (A, B, C) and unsatisfactory (D, F). These tables also report the descriptive statistics essential for calculating the two necessary prediction (regression) equations: the mean CLEP score and its standard deviation, the mean preliminary course grade and its standard deviation, and the correlation coefficient between the 274 scores and grades.

The Expected Score for each grade group (F- to A+) is noted in the bottom row of Table 5, and the Expected Grade for each CLEP score is listed in the second column of Table 6. Each set of values is calculated by means of the appropriate prediction equation, which is shown to the right of each table.

Tables 7 and 8 perform the same functions as those of Tables 3 and 4 in the report of results of the earlier study. Table 7 reveals the accuracy/inaccuracy of 10 scores that might be used for placement by calculating the numbers and percentages of students that would have been placed too high, correctly, or too low by each given score. Table 8 matches certain possible decision scores to the six guidelines often suggested for use in selecting the minimum score for credit.

A comparison of the 1982 data with those of 1979 reveals an increase of three points (from 55 to 58) in the mean CLEP scores of the two groups of students. The mean preliminary course grade advanced by .06 (2.99 to 3.05) on the four-point (0-4) scale and by .21 (9.95 to 10.16) on the 0-14 scale. Correlation coefficients likewise improved in the second study: from .59 to .62 on the 0-4 scale and from .59 to .65 on the 0-14 scale.

Table 5

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Frequency Distributions, Descriptive Statistics, and Expected Scores Spring Semester 1982

	Preliminary Course Grades (0-14) in EE 212														
Test Scores	0 F-	1 F	2 F+	3 D-	4 D	5 D+	6 C-	7 C	8 C+	9 B-	10 B	11 B+	12 A-	13 A	14 A+	Total
70-80								1				1		5	3	10
66-69	1		2		1						3	1	4	17	15	44
65											2		1	11	6	20
64													2	5	2	9
63				1						1	2			5	2	11
62									1				3	7	3	14
61										1	4			7	1	13
60										2	2	2	3	3	2	14
59						1			1		2	1	2	2		9
58			1								2		1	3	1	8
57					1			1		2				2	1	7
56				1	1			2	1	1	2	1		1		10
55			1	1						3	2	2	5	1	1	16
54											4	1	2			7
53											2			1		33
52							1	1	1	1	3		2	2		11
51					1		1		1		3		2			8
50	2					1				1	3					7
49	1	1									2		2			6
48					1	1	2		1	1				1		7
47					1		1		1		3					6
46					1			2	3		1					7
45		1		1												2
44				1												1
43	1		1			1			1							4
42			1				1	2		1						5
41								1								1
40			2		1				1	1						5
39																
38	1	1		1	1											4
37											1					1
36											1					1
35	1															2
34																
33	2															2
32																
31																
20-30																
Total	9	3		6	9		6	10		15	44		29	73		274
%		8			4			12			9			37		100%
Mean Score	44	44	51	50	50	50	48	51	50	54	55	60	58	63	65	58
Standard Deviation	10	5	11	9	8	6	3	9	6	6	7	6	6	5	4	9
Expected Score	42	44	45	47	48	50	51	53	54	56	57	59	60	62	63	

Mean Grade	Standard Deviation
10.16	3.82

Correlation Coefficient

r = .65

Expected Score =

$$\left(\text{Prelim. Grade} \times 1.4928\right) + (42.3873)$$

Table 6

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Combined Frequency Distributions and Expected Grades Spring Semester 1982

Test Scores	Expected Grades	Course Grades (0-14) Unsatisf. D-F	Satisf. A-C	Total
70-80	13.64-14.00		10	10
66-69	12.52-13.36	4	40	44
65	12.24		20	20
64	11.96		9	9
63	11.68	1	10	11
62	11.40		14	14
61	11.12		13	13
60	10.84		14	14
59	10.56	1	8	9
58	10.29	1	7	8
57	10.01	1	6	7
56	9.73	2	8	10
55	9.45	2	14	16
54	9.17		7	7
53	8.89		3	3
52	8.61		11	11
51	8.33	1	7	8
50	8.05	3	4	7
49	7.77	2	4	6
48	7.49	2	5	7
47	7.21	1	5	6
46	6.93	1	6	7
45	6.65	2		2
44	6.37	1		1
43	6.09	3	1	4
42	5.81	1	4	5
41	5.53		1	1
40	5.25	3	2	5
39	4.97			
38	4.69	4		4
37	4.41		1	1
36	4.13			
35	3.85	1	1	2
34	3.57			
33	3.29	2		2
32	3.01			
31	2.73			
20-30	(-9.34)-2.45			
Total	--	39	235	274
%	--	14 %	86 %	100%
Mean Score	--	48	59	58
Standard Deviation	--	9	8	9

Expected Grade = $\left(\text{Test Score} \times .2797\right) + (-5.9386)$

Mean Grade	Standard Deviation
10.16	3.82

Correlation Coefficient

r = .65

Table 7

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Possible Decision Scores and Corresponding Accuracies of Placement
Spring Semester 1982
(N = 274)

	Cumulative Numbers of Students				Percent of Students in Each Placement Category				Overall Accuracy of Placement		
Placement Category	Unsatisfactory D-F (N=39)		Satisfactory A-C (N=235)		Unsatisfactory D-F		Satisfactory A-C		Accuracy Category	No. of Students	% of Students
55- up	Too High	12	173	OK	Too High	31 %	74 %	OK	Too High	12	4 %
									Correct	200	73 %
Below 55	OK	27	62		OK	69 %	26 %	Too Low	Too Low	62	23 %
54 - up	Too High	12	180	OK	Too High	31 %	77 %	OK	Too High	12	4 %
									Correct	207	76 %
Below 54	OK	27	55	Too Low	OK	69 %	23 %	Too Low	Too Low	55	20 %
53 - up	Too High	12	183	OK	Too High	31 %	78 %	OK	Too High	12	4 %
									Correct	210	77 %
Below 53	OK	27	52	Too Low	OK	69 %	22 %	Too Low	Too Low	52	19 %
52 - up	Too High	12	194	OK	Too High	31 %	83 %	OK	Too High	12	4 %
									Correct	221	81 %
Below 52	OK	27	41	Too Low	OK	69 %	17 %	Too Low	Too Low	41	15 %
51 - up	Too High	13	201	OK	Too High	33 %	86 %	OK	Too High	13	5 %
									Correct	227	83 %
Below 51	OK	26	34	Too Low	OK	67 %	14 %	Too Low	Too Low	34	12 %
50 - up	Too High	16	205	OK	Too High	41 %	87 %	OK	Too High	16	6 %
									Correct	228	83 %
Below 50	OK	23	30	Too Low	OK	59 %	13 %	Too Low	Too Low	30	11 %
49 - up	Too High	18	209	OK	Too High	46 %	89 %	OK	Too High	18	7 %
									Correct	230	84 %
Below 49	OK	21	26	Too Low	OK	54 %	11 %	Too Low	Too Low	26	10 %
48 - up	Too High	20	214	OK	Too High	51 %	91 %	OK	Too High	20	7 %
									Correct	233	85 %
Below 48	OK	19	21	Too Low	OK	49 %	9 %	Too Low	Too Low	21	8 %
47 -up	Too High	21	219	OK	Too High	54 %	93 %	OK	Too High	21	8 %
			16						Correct	237	87 %
Below 47	OK	18		Too Low	OK	46 %	7 %	Too Low	Too Low	16	6 %
46 - up	Too High	22	225	OK	Too High	56 %	96 %	OK	Too High	22	8 %
									Correct	242	88 %
Below 46	OK	17	10	Too Low	OK	44 %	4 %	Too Low	Too Low	10	4 %

Table 8

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Scores Suggested by Six Guidelines for Selecting Decision Scores on CLEP Subject Examination in Elementary Computer Programming: Fortran IV (0-14 scale) Spring Semester 1982

Guideline	Score
1. Expected score for students whose performance in course was just minimally satisfactory--i.e., students with preliminary grades of C-. (See Expected Score row at bottom of Table 5.)	51
2. Score for which expected grade was just minimally satisfactory--i.e., C-. (See Expected Grade column in Table 6.)	43
3. Score for which percents of errors of students in each academic performance category (Unsatisfactory, Satisfactory) were most nearly equal. (See % Too High and % Too Low values in middle columns of Table 7.)	55
4. Score for which overall percents of errors were most nearly equal. (See % Too High and % Too Low values in last column of Table 7.)	48
5. Score that would have cut off (or held back) approximately the same number of students as were in the Unsatisfactory performance group. (See Table 6 for number of students in Unsatisfactory group and the test score that most nearly identifies that number of low-scoring students, as totaled in last column.)	48
6. Score that would have maximized overall accuracy of placement. (See Number Correct in next-to-last column of Table 7.)	46

In a meeting on June 17, 1982, MEC staff members recommended that the decision score for the minimum award of credit with a grade of C be raised from 50 to 51, that credit with a grade of B be granted at 56 instead of 57, and, finally, that credit with a grade of A be recognized at 60 instead of 64. The choices of the instructor, who expressed greater concern about errors of placement too high than too low, established the following score intervals for the placement system in Electrical Engineering 212:

CLEP Score Interval	Credit/No Credit
62-80	Credit with letter grade of A
56-61	Credit with letter grade of B
51-55	Credit with letter grade of C
20-50	No credit

APPENDIX

APPENDIX A

Test Descriptions and Sample Questions
1979
1982

Course Outline and Information Sheet
1982

21

Advanced Placement Test

for

EE 212

TIME: January 10, 1979 9-12 A.M.

PROCEDURE FOR TAKING QUIZ

This test is given as part of the University's on-campus testing program. A test fee of $29.00 must be paid in advance of taking the quiz. The fee may be paid at the Jester Auditorium ticket office January 5,6,9 or 10. The ticket office will be open at 7:00 A.M. January 10th. You will be given the location of the test when you pay your fee.

Reference Text:

1. Fortran For Humans by Didday
2. Numerical Methods and Fortran Programming by McCracken and Dorn

SCOPE OF TEST

You will be asked to develop flow charts and write a complete Fortran IV program for two or more stated problems. These problems may require a knowledge of

a. Iteration techniques
b. Matrix multiplication.
c. Summation of subscripted variables.
d. Complex variables.
e. Input - output of subscripted variables.

SAMPLE QUESTIONS

No. 1 Draw a flow chart and write a Fortran program for the following conditions. Read a set of test scores (one SCORE per card) whose values are integers between 0 and 100. A negative score will indicate the end of data. The program should keep track of the number of scores read (NO), the highest score encountered (HIGH) and the lowest score encountered (LOW). In addition the program should compute the average score (AVE). Printed output should include the number of scores (NO), the average score (AVE), the highest score (HIGH) and the lowest score (LOW). Illustrate how the output will appear on the line printer.

No. 2 Draw a flow chart and write a Fortran program for computing

$$Z = A \times B \times C$$

where A is a column vector with N elements,

B is a row vector with N elements,

and C is a NXN Matrix.

Assume the values for N,A,B and C are punched on cards. The integer variable is punched with an I5 Format and the real variables are punched in an 4E10.3 Format. The values of C are placed on the cards by rows such that the first value of a row is placed on a new card. The program must print the values of A,B,C and Z in a recognizable form. Assume $n \leq 10$.

The University of Texas at Austin
Measurement and Evaluation Center
2616 Wichita Street
Box 7246, Austin, TX 78712
(512) 471-3032

CREDIT BY EXAMINATION FOR ELECTRICAL ENGINEERING 212

Academic policies cover the period June 1981 through August 1982

U.T. Austin provides you with the opportunity to earn credit by examination. Such credit will satisfy degree requirements in the same way as credit earned by passing a course, except that it will not count as credit earned in residence. Although you may take tests before you enroll in U.T. Austin, you must be a currently or previously enrolled student to receive credit. Unsuccessful attempts to earn credit by examination will not become part of your official academic record.

Faculty members in the Department of Electrical Engineering select the test, set the level of performance required to earn credit, and specify who is eligible to take the test. The Measurement and Evaluation Center (MEC) assists the department by communicating policies, giving the test, and reporting the credit.

EE 212 CREDIT BASED ON EVALUATION of CLEP Subject Examination

The CLEP Subject Examination in Elementary Computer Programming—Fortran IV serves as a basis for credit by examination in Electrical Engineering Computation I (EE 212).

ELIGIBILITY FOR CREDIT BY EXAMINATION IN EE 212

To be eligible for credit, you must perform satisfactorily on the test, and you must not already have a passing or failing grade in EE 212 or an equivalent course. In order to claim credit for which you are eligible, you must be a currently or previously enrolled student.

REPEATING THE EXAMINATION

The CLEP Subject Examination in Elementary Computer Programming—Fortran IV may not be repeated within six months.

EXAMINATION FEE

The College Board fee for one CLEP Examination is $25.00 (subject to change).

Students with a significant degree of documented financial need are eligible for waiver of a reasonable number of test fees (contact Office of Student Financial Aid). Fee waivers should be presented at the fee-payment time(s) and place(s) listed on a test schedule.

LEVEL OF PERFORMANCE REQUIRED FOR CREDIT:

Test Score	Course Credit
64 and above	EE 212 with grade of *A*
57 – 63	EE 212 with grade of *B*
50 – 56	EE 212 with grade of *C*
49 and below	No Credit

Range of scores is 20 – 80

AMOUNT OF TIME NEEDED AT TEST CENTER

The time required for administration of the test—from report-time to dismissal—is about 2 hours. No one may leave until everyone is dismissed.

WHEN THE EXAMINATION IS OFFERED*

The CLEP Subject Examination in Elementary Computer Programming—Fortran IV is offered on our campus at Institutional Administrations limited to prospective students, currently-enrolled students, or former students of U.T. Austin.

Registration for the test consists of paying the $25.00 test fee (subject to change) at a specified time and place, usually on the test date or the previous day. Test schedules giving details will be available from the MEC no later than one month before the beginning of each test period. (For some periods, students can register in advance by mail; when advance registration is possible for a particular test period, the test schedule will give details.)

A schedule for the upcoming testing period is given on page 5. The test is regularly offered several days before registration for the fall and spring semesters, and the first summer term. It is also offered toward the middle of the fall and spring semesters, several days before preregistration for the next semester.

Test results are available within a few days of the test, before time for students to register or preregister for courses. The specific time and place are announced at the test administration.

---

*The last time this CLEP Subject Examination was offered in a nationwide CLEP Test Center was in June, 1982; currently, it can be taken only in an Institutional Administration.

CLAIMING CREDIT: PETITION FORM

No credit will be reported to the Registrar until you complete and return a petition form to the Measurement and Evaluation Center. If you are eligible to claim U.T. Austin credit by examination, you must decide (a) whether or not, (b) how, and (c) when to accept the credit. You cannot claim credit by examination for a course which already appears on your official academic record.

Whether or Not to Accept Credit:
If you wish not to accept credit, you should do nothing. If you wish to accept credit, you must follow the procedure outlined below.

How to Accept Credit:
Obtain a petition form from either the Measurement and Evaluation Center (MEC) or the General Information and Referral Service Desk (ground floor of the Main Building).

Using the petition form, instruct the MEC to report your credit in one of two ways, either of which will count toward fulfillment of degree requirements.

1. Semester hours of couse credit <u>with</u> grade. The credit, letter grade and equivalent grade points will become a part of your official academic record.
2. Semester hours of course credit <u>without</u> grade. The credit will become a part of your official academic record without letter grade or grade points. If credit with a letter grade will apply toward fulfillment of your degree requirements, then that same credit with the symbol CR will also apply. Credit without a grade will not affect the number of hours for which you may register on a pass-fail basis.

When to Accept Credit:
If you have not yet attended classes at U.T. Austin, please wait until after your first day of classes to submit your petition form.

If you petition during the first week of classes, your credit will be on your official record by the mid-semester preregistration period for the following semester. *You must petition at least one month before the end of classes in order for the credit to appear on that semester's grade report.*

DESCRIPTION OF THE CLEP SUBJECT EXAMINATION IN

ELEMENTARY COMPUTER PROGRAMMING--FORTRAN IV

The test is not based on a particular book; any good Fortran IV manual will do.

The Subject Examination in Elementary Computer Programming: Fortran IV is designed to measure knowledge, understanding, and skill equivalent to that normally gained from one semester of an introductory college course in Fortran IV. The test is not concerned with any particular computer or related types of hardware, nor does it attempt to measure your knowledge of the general field of data processing. Only questions directly related to Fortran IV will be asked. Because there are many variations of Fortran IV, the test attempts to measure only those elements of the language that are common to most users.

The test is composed of approximately 100 multiple-choice questions to be completed in 90 minutes. The elements of Fortran IV that are covered by the test and the approximate percentage of the total number of questions allocated to each element follow:

Content	*Percent of Test*
Constants	4
Variables	4
Arrays	4
Subscripts	2
Arithmetic Expressions	14
Logical & Arithmetic IF	10
Logical Expressions	4
GO TO	2
DO	14
READ & WRITE	18
DATA	2
DIMENSION	2
Explicit Type	2
COMMON	2
EQUIVALENCE	2
Statement Functions	4
Function Subprograms	4
Subroutine Subprograms	6

Classifications of the questions are not mutually exclusive. A DO loop, for example, may contain arithmetic and/or logical expressions as well as subscripted variables, constants, and so forth. In all cases, however, questions are classified on the basis of knowledge that is most important in determining the correct answer. Since the abilities to follow the logic of computer programs and to recognize discrete concepts within the context of actual programs are essential for any computer programmer, approximately 15 percent of the test questions are embedded within program segments.

Although there is a wide variation in the difficulty of individual questions on the test, most are intended to be of only moderate difficulty. Since the test is designed to be fair to people who have been prepared in different ways or have taken courses at different colleges, it is not expected that everyone taking the test will be able to answer every question.

The format of the multiple-choice questions may be quite different from those to which you are accustomed. It is suggested, therefore, that you study carefully the sample questions that follow.

SAMPLE QUESTIONS

Directions: **Each of the problems below consists of a question or an incomplete sentence followed by two statements, labeled I and II. You are to decide whether either, both, or neither of the two statements correctly answers the question or completes the sentence. Then, on the appropriate space on the answer sheet, you are to blacken space**

(A) if only statement I correctly answers the question or completes the sentence;
(B) if only statement II correctly answers the question or completes the sentence;
(C) if both statement I and statement II correctly answer the question or complete the sentence;
(D) if neither statement I nor statement II correctly answers the question or completes the sentence.

EXAMPLE A

Which of the following Fortran expressions assign(s) a value to X that is greater than 10.5?

I. X = 10.5 + 10.5 + 10.5
II. X = 1.3 + 1.3 + 1.3

The correct answer is A. Only the statement labeled I assigns a value to X that is greater than 10.5.

EXAMPLE B

Which of the following Fortran expressions is (are) valid?

I. 5X = GO, TO + * (
II. A = B + C

The correct answer is B. Only the statement labeled II is a valid Fortran expression.

EXAMPLE C

Which of the following Fortran expressions will result in N being set equal to 6?

I. N = 3 + 3
II. N = 2 * 3

The correct answer is C. Both the statement labeled I and the statement labeled II will result in N being set equal to 6.

EXAMPLE D

Every Fortran program must have

I. an EQUIVALENCE statement
II. a COMMON statement

The correct answer is D. Neither an EQUIVALENCE statement nor a COMMON statement is required in every Fortran program.

The preceding questions were included to familiarize you with the format of the questions and are much easier than most of the questions in the test itself. The following questions are more representative of the test questions in terms of difficulty and in the content that they cover.

Note: **Some of the test questions are based on segments of complete programs. You should assume that those parts of the program not specifically included in the test are correct and consistent with the information given. It will be to your advantage to read the questions based on a particular program segment before attempting to analyze the program segment itself. For the purposes of this test SQRT and SQRTF are to be considered equivalent.**

Questions **1-3 are based on the following table of variable values.**

Variable	*Value*
W	1.0
X	2.0
Y	3.0
Z	4.0

1. In which of the following statements does VAR have a negative value?

I. VAR = Z − (Y + X)
II. VAR = (Z − Y) + X

2. Which of the following groups of statements will assign a value of 18.0 to HOG?

I. PIG = X + Y + Z * W
HOG = PIG + X
II. PIG = Z + 5.0
HOG = PIG * Y

3. In which of the following statements is EL1 larger than 18?

I. EL1 = (Y − Z) ** Y
II. EL1 = (Y + Z) ** X

4. What is true of the following program segment?

```
      DIMENSION A(5, 6), B(6, 5)
   10 DO 30 I = 1, 5
   15 DO 20 J = 1, 6
   16 A(I, J) = B(J, I)
   20 CONTINUE
   30 CONTINUE
```

I. The outer loop will cycle five times.
II. The inner loop will cycle thirty times.

5. Which of the following program segments will send the computer to STATEMENT 20?

I.
```
F = 1.0
Y = F + 1.0
IF (Y)20, 19, 18
```
II.
```
F = 1.0
Y = F − 1.0
IF (Y) 20, 19, 18
```

6. What is true of the following program segment?

```
      LPC = 0
      DO 10 I = 1, 2
      KLT = I + 1
      DO 10 J = 1, 2
      LPC = LPC + KLT
   10 CONTINUE
      M = LPC + 4
```

I. The final value of M is 12.
II. The final value of KLT is 3.

7. Which of the following program segments will set all members of the array ARY equal to 0.0?

I.
```
      DIMENSION ARY (666)
      DO 99 JK = 1,666
   99 ARY(JK) = 0.0
```
II.
```
      DIMENSION ARY (666)
   99 JJ = 1
   98 ARY(JJ) = 0.0
      JJ = JJ + 1
      GO TO 99
      IF (JJ − 666) 98, 99, 99
```

8. Which of the following correctly represent(s) the algebraic expression $a = \frac{bc}{3} + \frac{d^2}{2} + e$?

I. A = B/3.0 * C + D * D/2.0 + E
II. A = B * C/3.0 + D ** 2/2.0 + E

9. Which of the following represent(s) correct usage of the DIMENSION and explicit type statements?

I.
```
INTEGER BIG
REAL JOB, N
DIMENSION NUMB(5), A(7), STD(15)
```
II.
```
INTEGER STD(15), BIG
REAL JOB,N, NUMB(5)
DIMENSION A(7)
```

ANSWER KEY TO SAMPLE QUESTIONS
(Elementary Computer Programming – Fortran IV)

1. A	3. B	5. D	7. A	9. C
2. D	4. C	6. B	8. C	

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UPCOMING INSTITUTIONAL ADMINISTRATIONS
of CLEP Subject Examinations
for U.T. Austin Students

Test Date: Monday, August 23, 1982. Report time is 9:00 a.m. You may take 1, 2, or 3 CLEP Subject Examinations at this time.

Test Fee Payment Dates and Times: You may pay the $25.00 test fee at the ticket office at Jester Center Auditorium on any one of these dates and times:

Friday, August 20, 1982	3:00 p.m. – 6:00 p.m.
Saturday, August 21, 1982	7:00 a.m. – 10:00 a.m. 12:00 N – 3:30 p.m. 4:30 p.m. – 8:00 p.m.
Sunday, August 22, 1982	12:00 N – 6:30 p.m.
Monday, August 23, 1982	8:00 a.m. – 9:00 a.m.

For August testing, you can register in advance: until August 7 by mail, and until August 13 in person at MEC. Forms are available from MEC.

The fee may be paid by cash, check or money order (payable to U.T. Austin) or by fee waiver.

Test Location and Admission
When you pay your test fee, you will be given at test-room admission slip which lists your test room. Since test rooms will be in buildings other than the one where you pay your fee, you should pay your fee early enough to allow you time to locate your test room.

At the test room, you will be expected to present a generally accepted form of identification that includes both your signature and recognizable photograph. Without such identification, you will be admitted only if you submit a photograph of yourself that will not be returned to you. You should take several sharpened No. 2 pencils to the test.

The time required for administration of the test – from report-time to dismissal is about 2 hours. No one may leave until everyone is dismissed.

EE 212 OUTLINE
(Spring 1982)

Date	Topic	Reading assignment in Richardson and Welch Chapters
Jan. 19	Introduction, running a FORTRAN program	1-5
Jan. 26	Writing a computer program	6
Feb. 2	Logic and transfer statements	7
Feb. 9	Types of variables and constants	8
Feb. 16	Roots of a polynomial	9
Feb. 23	Input-output	10
Mar. 2	Subscripted variables	11
Mar. 9	Mid-term quiz, 7 p.m. (no 8 a.m. class)	
Mar. 23	DO loops	12
Mar. 30	Matrix algebra	13
Apr. 6	Subroutines and functions	14
Apr. 13	Subroutines and functions	14
Apr. 20	Alpha numeric input and output	
Apr. 27	File structure, review	
May 4	Second hour quiz, 7 p.m. (no 8 a.m. class)	

The Richardson and Welch text is intended to guide you painlessly (?) through the basics of FORTRAN. It is not a detailed or even complete text on FORTRAN IV. You are expected to use the "MNF Reference Manual" as the complete source of information on the Cyber's FORTRAN compiler.

INFORMATION SHEET FOR EE 212
SPRING 1982

INSTRUCTOR: A.J. Welch
ENS 612
Office Hours: 9-11:30 T, 1-2 MW

TA's: Majid Amin, ENS 525
Carlos Davila, ENS 337
Carlos Bouffier, ENS 631B
Elizabeth Morris, ENS 536

TEXTS: "Everything You Always Needed to Know About our Computer" (1982 edition)
Phillip C. Richardson and Ashley J. Welch

"MNF Reference Manual for Cyber Series Computers"
L.A. Liddiord and E.J. Mudstock

GOAL OF COURSE: All students who complete EE 212 should be able to use FORTRAN IV for the solution of basic engineering problems.

GRADING:

Programs	25%	Hour Quizzes	30%
Pop Quizzes	25%	Final Quiz	20%

To receive a passing grade in the course, all programs must be completed and you must have a passing quiz grade (i.e., an average quiz score of 65).

For full credit, programs must be turned in on the date indicated on the next page. Your TA will give you instructions for turning in your homework. The maximum value of late programs will be reduced 50%. No credit will be given for homework over one week old. Students who have identical homework will not receive credit for their programs.

COMPUTER COST: Each student will be allowed $28 for computer time and supplies, and will be required to pay the department for any charges beyond that amount.

CONSULTANTS: The TA's and graders are available to help you during their posted office hours. The TA's will be in their offices and the graders will be in ENS 319. If you have a question about a program that is not working be sure to bring:

(a) entire job deck including data cards
(b) computer listing
(c) flowchart or list of statements illustrating the task sequence for solving the assigned problem

LECTURE SECTION: ATTENDANCE IS REQUIRED. Will begin at 8 a.m. sharp. Students should plan on being in their seats by 8 a.m. Slides used in the lectures will be related to the material in the text and homework. Reading assignments will be given, to enable students to read the material before it is presented in the lecture section.

RECITATION SECTION: ATTENDANCE IS REQUIRED AND ROLL WILL BE TAKEN. The recitation sections:

(a) supplement information provided in the lecture section
(b) amplify material covered in the lecture section
(c) discuss homework assignments
(d) provide time for questions and answers
(e) provide time for pop quizzes

DUE DATE FOR TURNING IN PROGRAMS

	TTh classes	WF classes
Program 1	Jan. 28	Jan. 29
2	Feb. 4	Feb. 5
3	Feb. 11	Feb. 12
4	Feb. 25	Feb. 26
5	Mar. 4	Mar. 5
6	Mar. 25	Mar. 26
7	Apr. 1	Apr. 2
8	Apr. 8	Apr. 9
9	Apr. 22	Apr. 23
10	Apr. 29	Apr. 30

TA's will give instructions for turning in homework.

FIRST HOUR QUIZ 7:00 p.m., Tuesday, March 9

SECOND HOUR QUIZ 7:00 p.m., Tuesday, May 4

FINAL QUIZ 7-10 p.m., Tuesday, May 18

APPENDIX B

Tables Using Four-Point Scale (0-4):

1979 Tables 9 - 12

1982 Tables 13 - 16

Table 9

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Frequency Distributions, Descriptive Statistics, and Expected Scores Spring Semester 1979

	Preliminary Course Grades (0-4) in EE 212					
Test Scores	0 F	1 D	2 C	3 B	4 A	Total
70-80					2	2
66-69					5	5
65					5	5
64					2	2
63				2	3	5
62				2	6	8
61				1	4	5
60		1		3	3	7
59				1	1	2
58			1	5	3	9
57			1	2	1	4
56		1	1		4	6
55				1		1
54		2	1	4	1	8
53	1				1	2
52			1	3	1	5
51		1	1	3	2	7
50			1		1	2
49		2		1	2	5
48			1	1		2
47	2	1	1	1		5
46			2			2
45				1		1
44						
43		1	1			2
42			1	2		3
41						
40	1		1	1		3
39						
38			1			1
37				1		1
36	1					1
35						
34						
33						
32						
31						
20-30						
Total	5	9	15	35	47	111
%	5%	8%	14%	32%	42%	100%
Mean Score	45	51	49	54	60	55
Standard Deviation	7	5	6	7	6	8
Expected Score	43	47	51	55	59	

Mean Grade	Standard Deviation
2.99	1.13

Correlation Coefficient

r = .59

Expected Score =

$$\left(\text{Prelim. Grade} \times 4.0101\right) + (43.3121)$$

Table 10

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212:
Combined Frequency Distributions and Expected Grades
Spring Semester 1979

Test Scores	Expected Grades	Course Grades (0-4) Unsatisf. D-F (0,1)	Satisf. A-C (2-4)	Total
70-80	4.00-4.00		2	2
66-69	3.91-4.00		5	5
65	3.82		5	5
64	3.74		2	2
63	3.65		5	5
62	3.57		8	8
61	3.48		5	5
60	3.39	1	6	7
59	3.31		2	2
58	3.22		9	9
57	3.14		4	4
56	3.05	1	5	6
55	2.97		1	1
54	2.88	2	6	8
53	2.79	1	1	2
52	2.71		5	5
51	2.62	1	6	7
50	2.54		2	2
49	2.45	2	3	5
48	2.37		2	2
47	2.28	3	2	5
46	2.19		2	2
45	2.11		1	1
44	2.02			
43	1.94	1	1	2
42	1.85		3	3
41	1.76			
40	1.68	1	2	3
39	1.59			
38	1.51		1	1
37	1.42		1	1
36	1.34	1		1
35	1.25			
34	1.16			
33	1.08			
32	0.99			
31	0.91			
20-30	0.04-0.82			
Total	--	14	97	111
%	--	13%	87%	100%
Mean Score	--	49	56	55
Standard Deviation	--	6	8	8

Expected Grade = (Test Score x 0.0858) + (-1.7531)

Mean Grade	Standard Deviation
2.99	1.13

Correlation Coefficient
r = .59

Table 11

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Possible Decision Scores and Corresponding Accuracies of Placement
Spring Semester 1979
(N = 111)

	Cumulative Numbers of Students				Percent of Students in Each Placement Category				Overall Accuracy of Placement		
Placement Category	Unsatisfactory D-F (N=14)		Satisfactory A-C (N=97)		Unsatisfactory D-F		Satisfactory A-C		Accuracy Category	No. of Students	% of Students
53 - up	Too High	5	66	OK	Too High	36 %	68 %	OK	Too High	5	5 %
									Correct	75	68 %
Below 53	OK	9	31	Too Low	OK	64 %	32 %	Too Low	Too Low	31	28 %
52 - up	Too High	5	71	OK	Too High	36 %	73 %	OK	Too High	5	5 %
									Correct	80	72 %
Below 52	OK	9	26	Too Low	OK	64 %	27 %	Too Low	Too Low	26	23 %
51 - up	Too High	6	77	OK	Too High	43 %	79 %	OK	Too High	6	5 %
									Correct	85	77 %
Below	OK	8	20	Too Low	OK	57 %	21 %	Too Low	Too Low	20	18 %
50 - up	Too High	6	79	OK	Too High	43 %	81 %	OK	Too High	6	5 %
									Correct	87	78 %
Below 50	OK	8	18	Too Low	OK	57 %	19 %	Too Low	Too Low	18	16 %
49 - up	Too High	8	82	OK	Too High	57 %	85 %	OK	Too High	8	7 %
									Correct	88	79 %
Below 49	OK	6	15	Too Low	OK	43 %	15 %	Too Low	Too Low	15	14 %
48 - up	Too High	8	84	OK	Too High	57 %	87 %	OK	Too High	8	7 %
									Correct	90	81 %
Below 48	OK	6	13	Too Low	OK	43 %	13 %	Too Low	Too Low	13	12 %
47 - up	Too High	11	86	OK	Too High	79 %	89 %	OK	Too High	11	10 %
									Correct	89	80 %
Below 47	OK	3	11	Too Low	OK	21 %	11 %	Too Low	Too Low	11	10 %
↓											
44 -up	Too High	11	89	OK	Too High	79 %	92 %	OK	Too High	11	10 %
									Correct	92	83 %
Below 44	OK	3	8	Too Low	OK	21 %	8 %	Too Low	Too Low	8	7 %
37 - up	Too High	13	97	OK	Too High	93 %	100 %	OK	Too High	13	12 %
									Correct	98	88 %
Below 37	OK	1	0	Too Low	OK	7 %	0 %	Too Low	Too Low	0	7 %

Table 12

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Scores Suggested by Six Guidelines for Selecting Decision Scores On CLEP Subject Examination in Elementary Computer Programming: Fortran IV (0-4 scale)
Spring Semester 1979
(N = 111)

Guideline	Score
1. Expected score for students whose performance in course was just minimally satisfactory--i.e., students with preliminary grades of C. (See Expected Score row at bottom of Table 9.)	51
2. Score for which expected grade was just minimally satisfactory--i.e., C. (See Expected Grade column in Table 10.)	44
3. Score for which percents of errors of students in each academic performance category (Unsatisfactory, Satisfactory) were most nearly equal. (See % Too High and % Too Low values in middle columns of Table 11.)	53
4. Score for which overall percents of errors were most nearly equal. (See % Too High and % Too Low values in last column of Table 11.)	47
5. Score that would have cut off (or held back) approximately the same number of students as were in the Unsatisfactory performance group. (See Table 10 for number of students in Unsatisfactory group and the test score that most nearly identifies that number of low-scoring students, as totaled in last column.)	47
6. Score that would have maximized overall accuracy of placement. (See Number Correct in next-to-last column of Table 11.)	37

Table 13

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Frequency Distributions, Descriptive Statistics, and Expected Scores Spring Semester 1982

Test Scores	Preliminary Course Grades (0-4) in EE 212					Total
	0 F	1 D	2 C	3 B	4 A	
70-80			1	1	8	10
66-69	3	1		4	36	44
65				2	18	20
64					9	9
63		1		3	7	11
62			1		13	14
61				5	8	13
60				6	8	14
59		1	1	3	4	9
58	1			2	5	8
57		1	1	2	3	7
56		2	3	4	1	10
55	1	1		7	7	16
54				5	2	7
53				2	1	3
52			3	4	4	11
51		1	2	3	2	8
50	2	1		4		7
49				2	2	6
48	2	2	3	1	1	7
47		1	2	3		6
46		1	5	1		7
45	1	1				2
44		1				1
43	2	1	1			4
42	1		3	1		5
41			1			1
40	2	1	1	1		5
39						
38	2	2				4
37				1		1
36						
35	1			1		2
34						
33	2					2
32						
31						
20-30						
Total	20	19	28	68	139	274
%	7 %	7 %	10 %	25 %	51 %	100%
Mean Score	47	50	50	55	63	58
Standard Deviation	10	8	7	7	5	9
Expected Score	44	49	53	57	62	

Mean Grade	Standard Deviation
3.05	1.24

Correlation Coefficient

r = .62

Expected Score =

$$\left(\text{Prelim. Grade} \times 4.3936\right) + (44.1654)$$

Table 14

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212:
Combined Frequency Distributions and Expected Grades
Spring Semester 1982

Test Scores	Expected Grades	Course Grades (0-4) Unsatisf. D-F	Satisf. A-C	Total
70-80	4.00		10	10
66-69	3.78	4	40	44
65	3.70		20	20
64	3.61		9	9
63	3.52	1	10	11
62	3.43		14	14
61	3.35		13	13
60	3.26		14	14
59	3.17	1	8	9
58	3.09	1	7	8
57	3.00	1	6	7
56	2.91	2	8	10
55	2.82	2	14	16
54	2.74		7	7
53	2.65		3	3
52	2.56		11	11
51	2.48	1	7	8
50	2.39	3	4	7
49	2.30	2	4	6
48	2.21	2	5	7
47	2.13	1	5	6
46	2.04	1	6	7
45	1.95	2		2
44	1.87	1		1
43	1.78	3	1	4
42	1.69	1	4	5
41	1.60		1	1
40	1.52	3	2	5
39	1.43			
38	1.34	4		4
37	1.26		1	1
36	1.17			
35	1.08	1	1	2
34	0.99			
33	0.91	2		2
32	0.82			
31	0.73			
20-30	(-0.23)-0.65			
Total	--	39	235	274
%	--	14 %	86 %	100%
Mean Score	--	48	59	58
Standard Deviation	--	9	8	9

Expected Grade =

$$\left(\text{Test Score} \times .0872\right) + (-1.9700)$$

Mean Grade	Standard Deviation
3.05	1.24

Correlation Coefficient

r = .62

Table 15

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Possible Decision Scores and Corresponding Accuracies of Placement
Spring Semester 1982
(N = 274)

	Cumulative Numbers of Students				Percent of Students in Each Placement Category				Overall Accuracy of Placement		
Placement Category	Unsatisfactory D-F (N=39)		Satisfactory A-C(N=225)		Unsatisfactory D-F		Satisfactory A-C		Accuracy Category	No. of Students	% of Students
55 - up	Too High	12	173	OK	Too High	31 %	74 %	OK	Too High	12	3 %
									Correct	200	73 %
Below 55	OK	27	62	Too Low	OK	69 %	26 %	Too Low	Too Low	62	23 %
54 - up	Too High	12	180	OK	Too High	31 %	77 %	OK	Too High	12	4 %
									Correct	207	76 %
Below 54	OK	27	55	Too Low	OK	69 %	23 %	Too Low	Too Low	55	20 %
53 - up	Too High	12	183	OK	Too High	31 %	78 %	OK	Too High	12	4 %
									Correct	210	77 %
Below 53	OK	27	52	Too Low	OK	69 %	22 %	Too Low	Too Low	52	19 %
52 - up	Too High	12	194	OK	Too High	31 %	83 %	OK	Too High	12	4 %
									Correct	221	81 %
Below 52	OK	27	49	Too Low	OK	69 %	17 %	Too Low	Too Low	41	15 %
51 - up	Too High	13	201	OK	Too High	33 %	86 %	OK	Too High	13	5 %
									Correct	227	83 %
Below 51	OK	26	34	Too Low	OK	67 %	14 %	Too Low	Too Low	34	12 %
50 - up	Too High	16	205	OK	Too High	41 %	87 %	OK	Too High	16	6 %
									Correct	228	83 %
Below 50	OK	23	30	Too Low	OK	59 %	13 %	Too Low	Too Low	30	11 %
49 - up	Too High	18	209	OK	Too High	46 %	89 %	OK	Too High	18	7 %
									Correct	230	84 %
Below 49	OK	21	26	Too Low	OK	54 %	11 %	Too Low	Too Low	26	10 %
48 - up	Too High	20	214	OK	Too High	51 %	91 %	OK	Too High	20	7 %
									Correct	233	85 %
Below 48	OK	19	21	Too Low	OK	49 %	9 %	Too Low	Too Low	21	8 %
47 -up	Too High	21	219	OK	Too High	54 %	93 %	OK	Too High	21	8 %
								Too	Correct	237	87 %
Below 47	OK	18	16	Too Low	OK	46 %	7 %	Low	Too Low	16	6 %
46 - up	Too High	22	225	OK	Too High	56 %	96 %	OK	Too High	22	8 %
									Correct	242	88 %
Below 46	OK	17	10	Too Low	OK	44 %	4 %	Too Low	Too Low	10	4 %

Table 16

End-of-Course CLEP Scores in Relation to Performance in Electrical Engineering 212: Scores Suggested by Six Guidelines for Selecting Decision Scores on CLEP Subject Examination in Elementary Computer Programming-Fortran IV (0-4 scale)
Spring Semester 1982
(N = 274)

Guideline	Score
1. Expected score for students whose performance in course was just minimally satisfactory--i.e., students with preliminary grades of C. (See Expected Score row at bottom of Table 13.)	53
2. Score for which expected grade was just minimally satisfactory--i.e., C. (See Expected Grade column in Table 14.)	46
3. Score for which percents of errors of students in each academic performance category (Unsatisfactory, Satisfactory) were most nearly equal. (See % Too High and % Too Low values in middle columns of Table 15.)	55
4. Score for which overall percents of errors were most nearly equal. (See % Too High and % Too Low values in last column of Table 15.)	48
5. Score that would have cut off (or held back) approximately the same number of students as were in the Unsatisfactory performance group. (See Table 14 for number of students in Unsatisfactory group and test score that most nearly identifies that number of low-scoring students, as totaled in last column.)	48
6. Score that would have maximized overall accuracy of placement. (See Number Correct in next-to-last column of Table 15.)	46